Saugatuck River Watershed Summary

Beaver Brook, Kettle Creek, and Poplar Plain Brook

WATERSHED DESCRIPTION AND MAPS

The Saugatuck River watershed covers an area of approximately 31,075 acres in the southwestern corner of Connecticut (Figure 1). There are multiple towns located in the watershed, including the municipalities of Ridgefield, Danbury, Bethel, Redding, Easton, Weston, Wilton, Fairfield, Norwalk, and Westport, CT.

The Saugatuck River watershed includes three segments impaired for recreation due to elevated bacteria levels. These segments were assessed by Connecticut Department of Energy and Environmental Protection (CT DEEP) and included in the CT 2010 303(d) list of impaired waterbodies. Some segments in the watershed were currently unassessed as of the writing of this document. However, this does not mean there are no problems on those segments, but is an indication that there are not current data to evaluate the segments as part of an assessment process. An excerpt of the Integrated Water Quality Report is included in Table 1 to show the status of some of the other waterbodies in the watershed.

The three impaired segments in the Saugatuck River watershed are tributaries to the Saugatuck River. Beaver Brook begins just north of Beaver Brook Pond in Weston, CT. The bacteria impaired segment (CT7200-22_01) consists of 1.02 miles of the brook in Weston, CT (Figures 2 and 6). This impaired segment of Beaver Brook begins just downstream of the confluence with Davidge Brook. The brook continues south and flows into the Saugatuck River just downstream of the Slumber Lane crossing.

Kettle Creek begins near Norfield Road in Weston, CT. The bacteria impaired segment (CT7200-24_01) consists of 0.62 miles of the brook (Figures 2 and 7). This impaired segment of Kettle Creek begins just downstream of the intersection with Kettle Creek Road. The brook continues south and flows into the Saugatuck River near the Good Hill Road crossing.

Poplar Plain Brook begins just northeast of the Patrick Wetlands near Route 15 in Westport, CT. The bacteria impaired segment (CT7200-26_01) consists of 0.5 miles

Impaired Segment Facts

Impaired Segments:
1. Beaver Brook (CT7200-22_01)
2. Kettle Creek (CT7200-24_01)
3. Poplar Plain Brook (CT7200-26-01)

Municipalities: Weston and Westport

Impaired Segments and Lengths (miles): 7200-22_01 (1.02), 7200-24_01 (0.62), and 7200-26_01 (0.5)

Water Quality Classifications: Classes A (1-3)

Designated Use Impairments: Recreation

Sub-regional Basin Name and Code: Saugatuck River, 7200

Regional Basin: Saugatuck

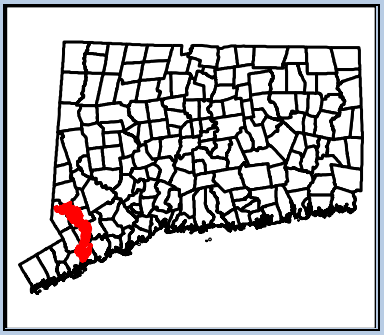
Major Basin: Southwest Coastal

Watershed Area (acres): 31,075

MS4 Applicable? Yes

Applicable Season: Recreation Season (May 1 to September 30)

Figure 1: Watershed location in Connecticut



of the brook (Figures 2 and 7). This impaired segment of Poplar Plain Brook begins just downstream of the intersection with Route 33. The brook continues east and flows into the Saugatuck River near Lee Pond.

Table 1: Impaired segments and nearby waterbodies from the Connecticut 2010 Integrated Water Quality Report

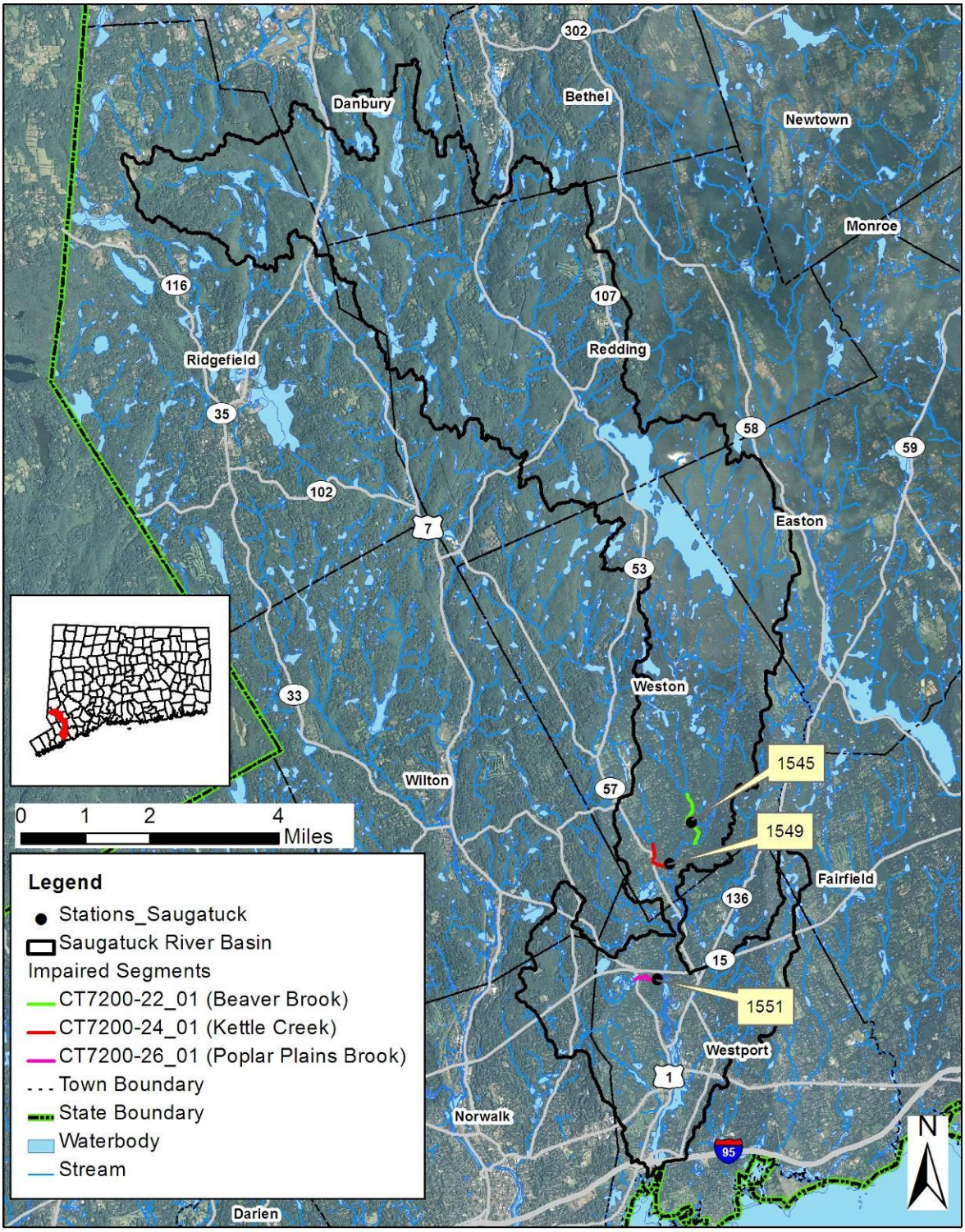
Waterbody ID	Waterbody Name	Location	Miles	Aquatic Life	Recreation	Fish Consumption
CT7200-00_01	Saugatuck River-01	From Hydraulic Pond OUTLET dam (head of estuary, saltwater limit), US (through Hydraulic Pond and lower end of Lee Pond) to confluence with West Branch Saugatuck River (parallel with Ford Road), Westport.	1.74	FULL	U	FULL
CT7200-00_02	Saugatuck River-02	From confluence with West Branch Saugatuck River (parallel with Ford Road), Westport, US (through upper end of Lee Pond) to Samuel Senior dam at Saugatuck Reservoir outlet, Weston.	6.46	U	U	FULL
CT7200-00_03	Saugatuck River-03	From INLET to Saugatuck Reservoir at Newtown Turnpike (Route 53) crossing, US to confluence with Bogus Mountain Brook (US of Redding Road (Route 53) crossing, and parallel to Station Road), Redding.	4.36	FULL	FULL	FULL
CT7200-00_04	Saugatuck River-04	From confluence with Bogus Mountain Brook (US of Redding Road (Route 53) crossing, and parallel to Station Road), Redding, US to headwaters, at Wataba Lake outlet dam (just US of Mountain Road crossing), Ridgefield.	5.53	FULL	U	FULL
CT7200-22_01	Beaver Brook (Weston)-01	From mouth at confluence with Saugatuck River (DS Slumber Lane crossing), US to confluence with Davidge Brook (adjacent to Glenwood Road), Weston.	1.02	U	NOT	FULL
CT7200-24_01	Kettle Creek (Weston)-01	From mouth at confluence with Saugatuck River (DS of Good Hill Road crossing), US to confluence with unnamed tributary (DS of Kettle Creek Road crossing), Weston.	0.62	U	NOT	FULL
CT7200-26_01	Poplar Plains Brook (Westport)-01	From mouth at confluence with Saugatuck River (Lee Pond section, just DS of Route 15 crossing), US to confluence with unnamed tributary US of Route 33 (Wilton Road) crossing (outlet for Keenes Pond), Westport.	0.5	U	NOT	FULL

Shaded cells indicate impaired segment addressed in this TMDL
FULL = Designated Use Fully Supported
NOT = Designated Use Not Supported
U = Unassessed

These three impaired segments have a water quality classification of A. Designated uses include potential drinking water supplies, habitat for fish and other aquatic life and wildlife, recreation, navigation, and industrial and agricultural water supply. These impaired segments are impaired for recreation due to elevated bacteria levels. As there are no designated beaches in these segments, the specific impairment is for recreation for non-designated swimming and other contact water-related activities.

To get a complete picture of the Saugatuck watershed, there are estuary segments included in the Westport Fairfield appendix, number 76, this document completes the picture of the watershed. CT-W1_010-SB and CT-W2_010 are the connected segments. There are additional data points and information detailing sources of impairment for these pieces of the Saugatuck watershed.

Figure 2: GIS map featuring general information of the Saugatuck River watershed at the sub-regional level



Bacteria Impairments In The Saugatuck River Sub Regional Basin

Map Data: CT DEEP Map Created: July 2011

Land Use

The existing land use in a watershed can affect the water quality of the waterbodies within that watershed (USEPA, 2011c). In an undeveloped watershed, natural processes such as infiltration of stormwater into the soil and plant uptake of water and nutrients can occur. As watersheds become more developed with commercial, residential, and industrial land uses, the amount of stormwater runoff increases as the natural landscape is altered with impervious surfaces, such as rooftops, roads, and sidewalks. The amount of pollutants, such as nutrients and bacteria from failing and insufficient septic systems, oil and grease from automobiles, and sediment from construction activities, can also increase, can become entrained in this runoff, and negatively affect nearby waterbodies. Agricultural land use activities, such as fertilizer application and manure from livestock, can also increase pollutants in nearby waterbodies (USEPA, 2011c).

As shown in Figures 3 and 4, the Saugatuck River watershed consists of 61% forest, 28% urban area, 9% water, and 2% agriculture. Though agricultural land uses only occupy 2% of the watershed, multiple agricultural operations can be found in this portion of the watershed (Figure 4). By contrast, the southern portions of the watershed in Weston and Westport are more developed, particularly in Westport in the areas surrounding Poplar Plains Brook (Figure 4).

Figure 3: Land uses within the Saugatuck River watershed

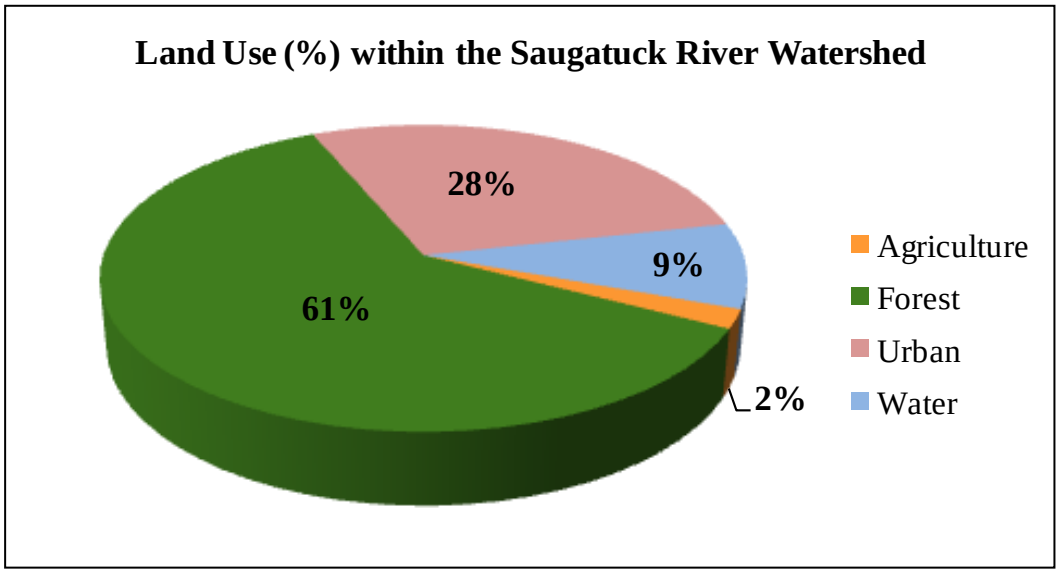
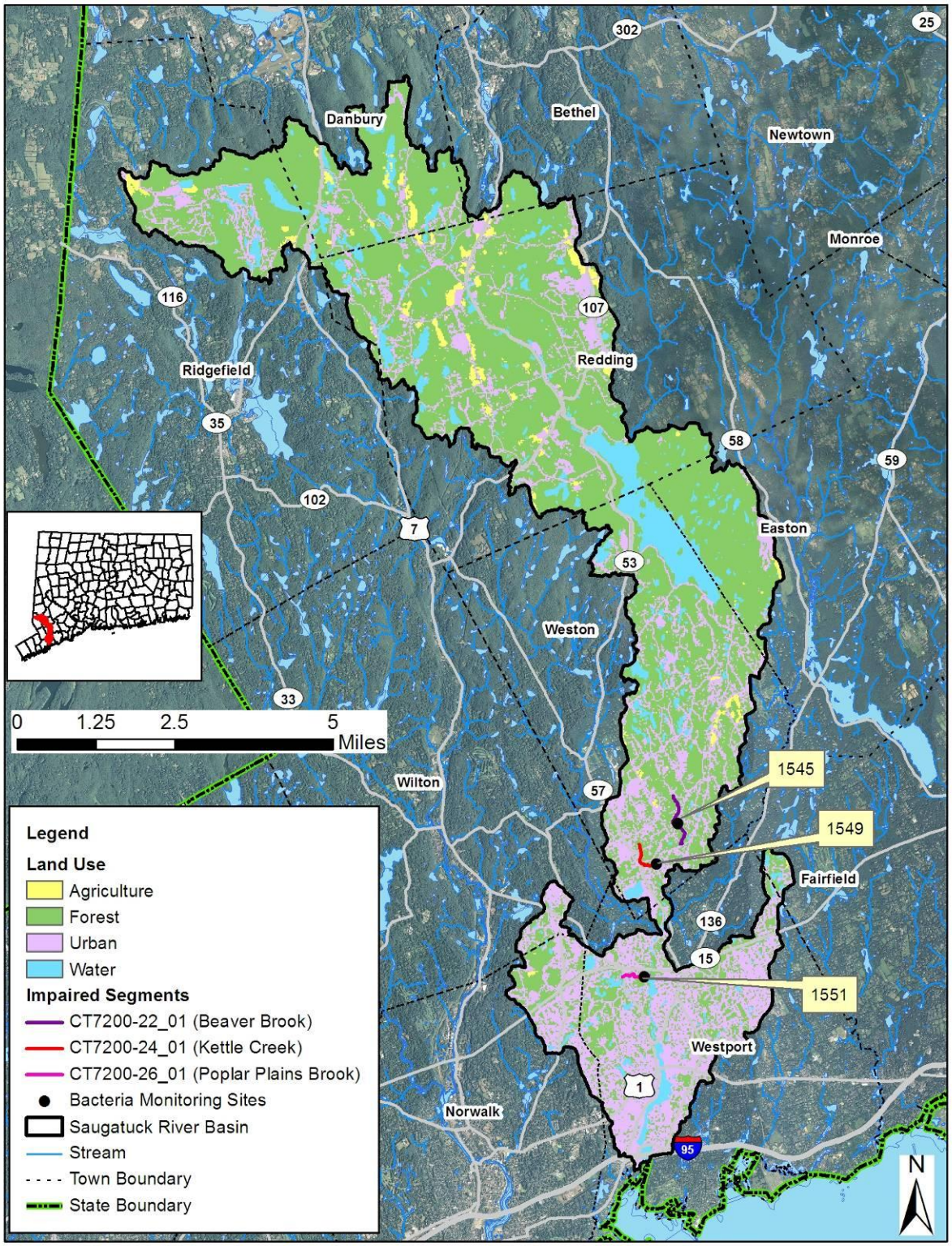


Figure 4: GIS map featuring land use for the Saugatuck River watershed at the sub-regional level



Land Use In The Saugatuck River Sub Regional Basin

Map Data: CT DEEP Map Created: July 2011

WHY IS A TMDL NEEDED?

E. coli is the indicator bacteria used for comparison with the CT state criteria in the CT Water Quality Standards (WQS) (CTDEEP, 2011). All data results are from CT DEEP, USGS, Bureau of Aquaculture or volunteer monitoring efforts at stations located on the impaired segments.

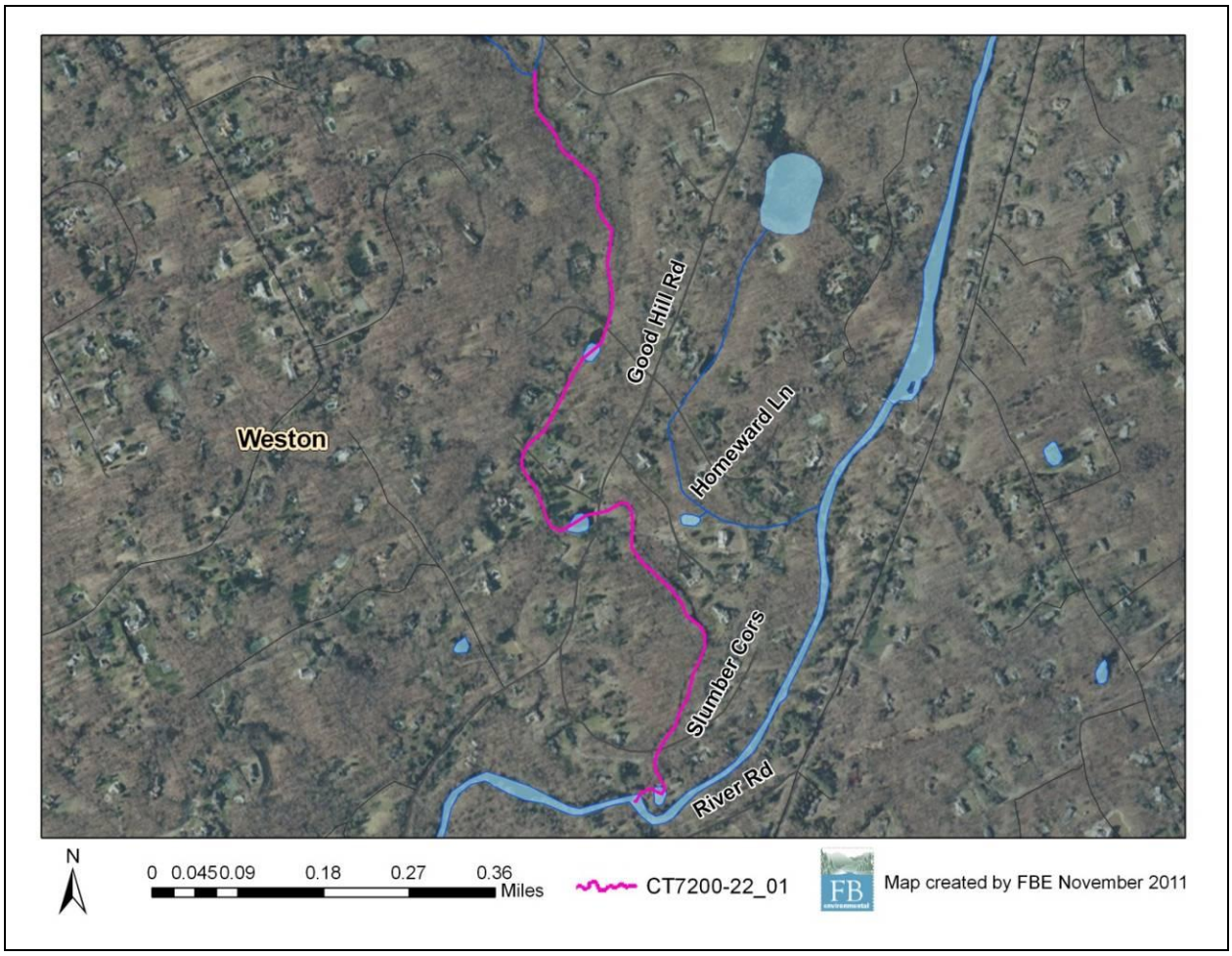
Table 2: Sampling station location description for the impaired segments in the Saugatuck River watershed

Waterbody ID	Waterbody Name	Station	Station Description	Municipality	Latitude	Longitude
CT7200-22_01	Beaver Brook	1545	Good Hill Road	Weston	41.19719444	-73.35922222
CT7200-24_01	Kettle Creek	1549	Good Hill Road	Weston	41.18786111	-73.36558333
CT7200-26_01	Poplar Plain Brook	1551	Route 33 at Camp M footbridge	Westport	41.16177778	-73.36913889

Beaver Brook (CT7200-22_01) is a Class A freshwater river. Its applicable designated uses are a potential drinking water supply, habitat for fish and other aquatic life and wildlife, recreation, navigation, and industrial and agricultural water supply. Water quality analyses were conducted using data from one sampling location from 2005 - 2008 (Station 1545) (Table 2). The water quality criteria for *E. coli*, along with bacteria sampling results from 2005 -2008 are presented in Table 12. The annual geometric mean was calculated for all years and exceeded the WQS for *E. coli* in 2007. Single sample values for Station 1545 exceeded the WQS for *E. coli* on at least one date in all years except 2008.

To aid in identifying possible bacteria sources, the geometric mean was also calculated for wet-weather and dry-weather sampling days at Station 1545, where appropriate (Tables 12). For Beaver Brook, the wet-weather geometric means exceeded the WQS for *E. coli*.

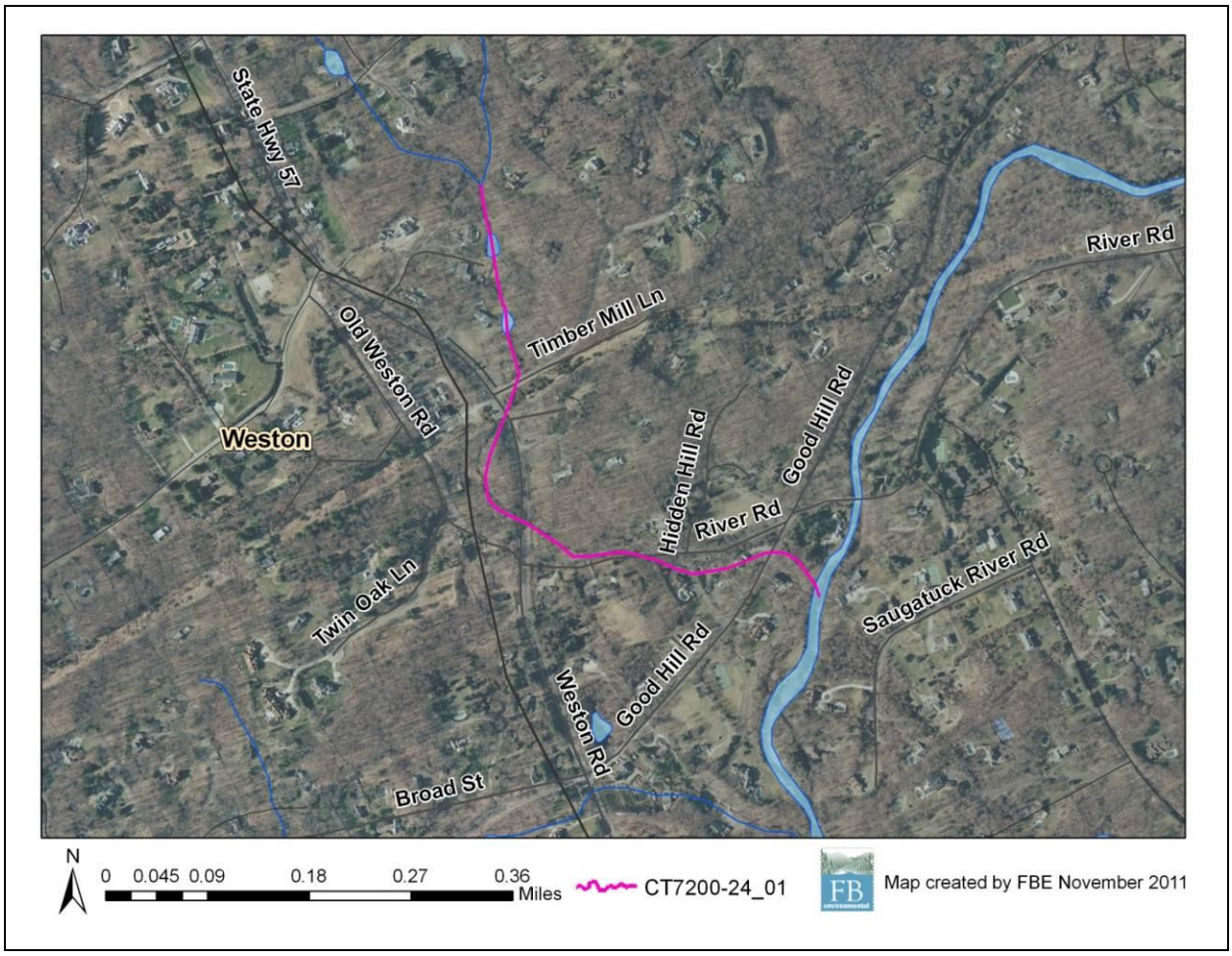
Figure 5: Aerial map of Beaver Brook



Kettle Creek (CT7200-24_01) is a Class A freshwater river. Its applicable designated uses are a potential drinking water supply, habitat for fish and other aquatic life and wildlife, recreation, navigation, and industrial and agricultural water supply. Water quality analyses were conducted using data from one sampling location from 2005 - 2008 (Station 1549) (Table 2). The water quality criteria for *E. coli*, along with bacteria sampling results from 2005 -2008 are presented in Table 13. The annual geometric mean was calculated for all years and exceeded the WQS for *E. coli* in 2006 and 2007. Single sample values for Station 1549 exceeded the WQS for *E. coli* on at least one date in all years.

To aid in identifying possible bacteria sources, the geometric mean was also calculated for wet-weather and dry-weather sampling days at Kettle Creek, where appropriate (Table 13). For Kettle Creek, neither the wet nor the dry-weather geometric means exceeded the WQS for *E. coli*.

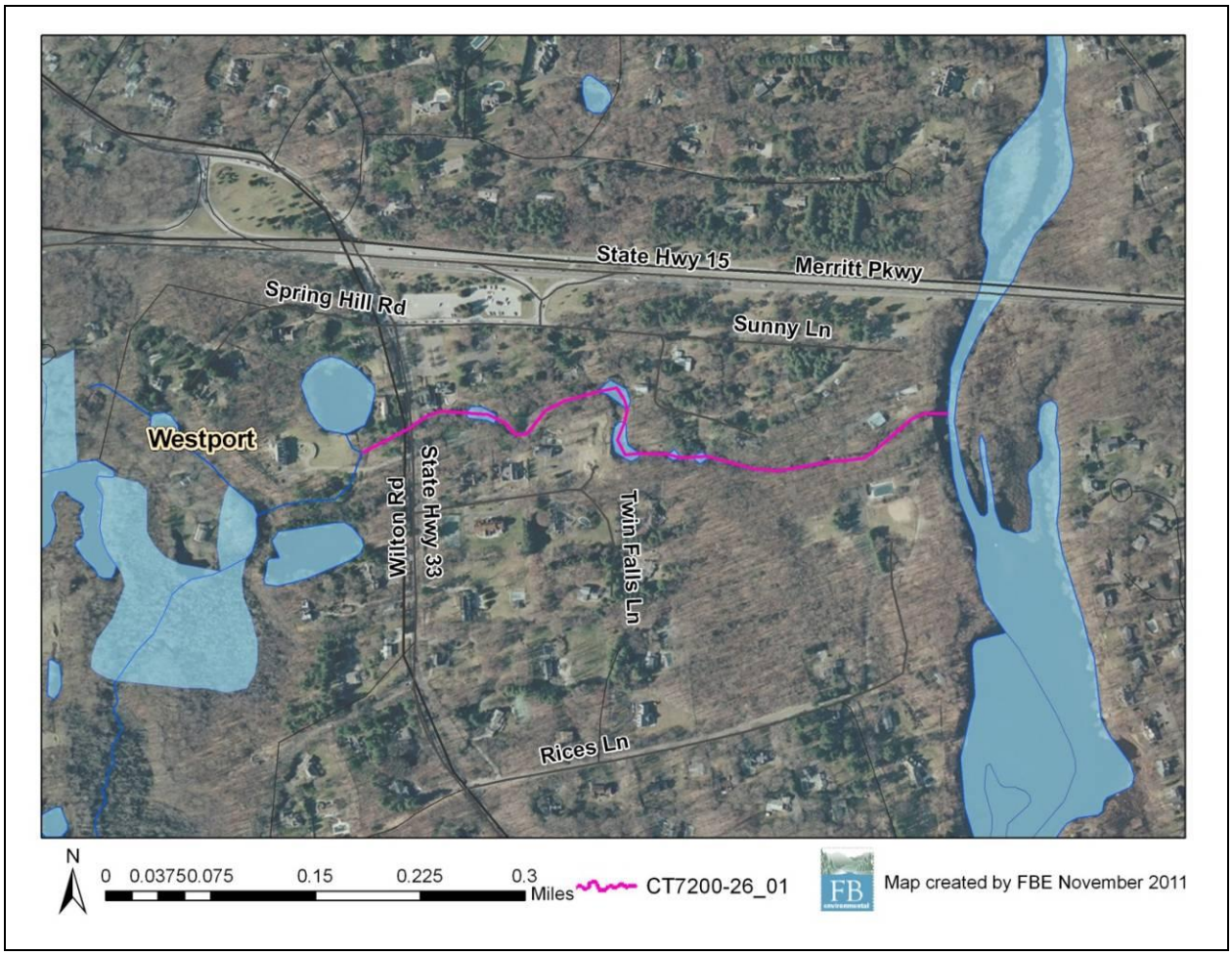
Figure 6: Aerial map of Kettle Creek



Poplar Plain Brook (CT7200-26_01) is a Class A freshwater river. Its applicable designated uses are a potential drinking water supply, habitat for fish and other aquatic life and wildlife, recreation, navigation, and industrial and agricultural water supply. Water quality analyses were conducted using data from one sampling location from 2005 - 2008 (Station 1551). The water quality criteria for *E. coli*, along with bacteria sampling results from 2005 -2008 are presented in Table 14. The annual geometric mean was calculated for all years and exceeded the WQS for *E. coli* in 2007 and 2008. Single sample values for Station 1551 exceeded the WQS for *E. coli* on at least one date in all years except 2008.

To aid in identifying possible bacteria sources, the geometric mean was also calculated for wet-weather and dry-weather sampling days for Station 1551, where appropriate (Table 14). For Poplar Plain Brook, the wet-weather geometric means exceeded the WQS for *E. coli*.

Figure 7: Aerial map of Poplar Plain Brook



Due to the elevated bacteria measurements presented in Table 12 - 14, these three impaired segments do not meet CT's bacteria WQS, were identified as impaired, and were placed on the CT List of Waterbodies Not Meeting Water Quality Standards, also known as the CT 303(d) Impaired Waters List. The Clean Water Act requires that all 303(d) listed waters undergo a TMDL assessment that describes the impairments and identifies the measures needed to restore water quality. The goal is for all water bodies to comply with state WQS.

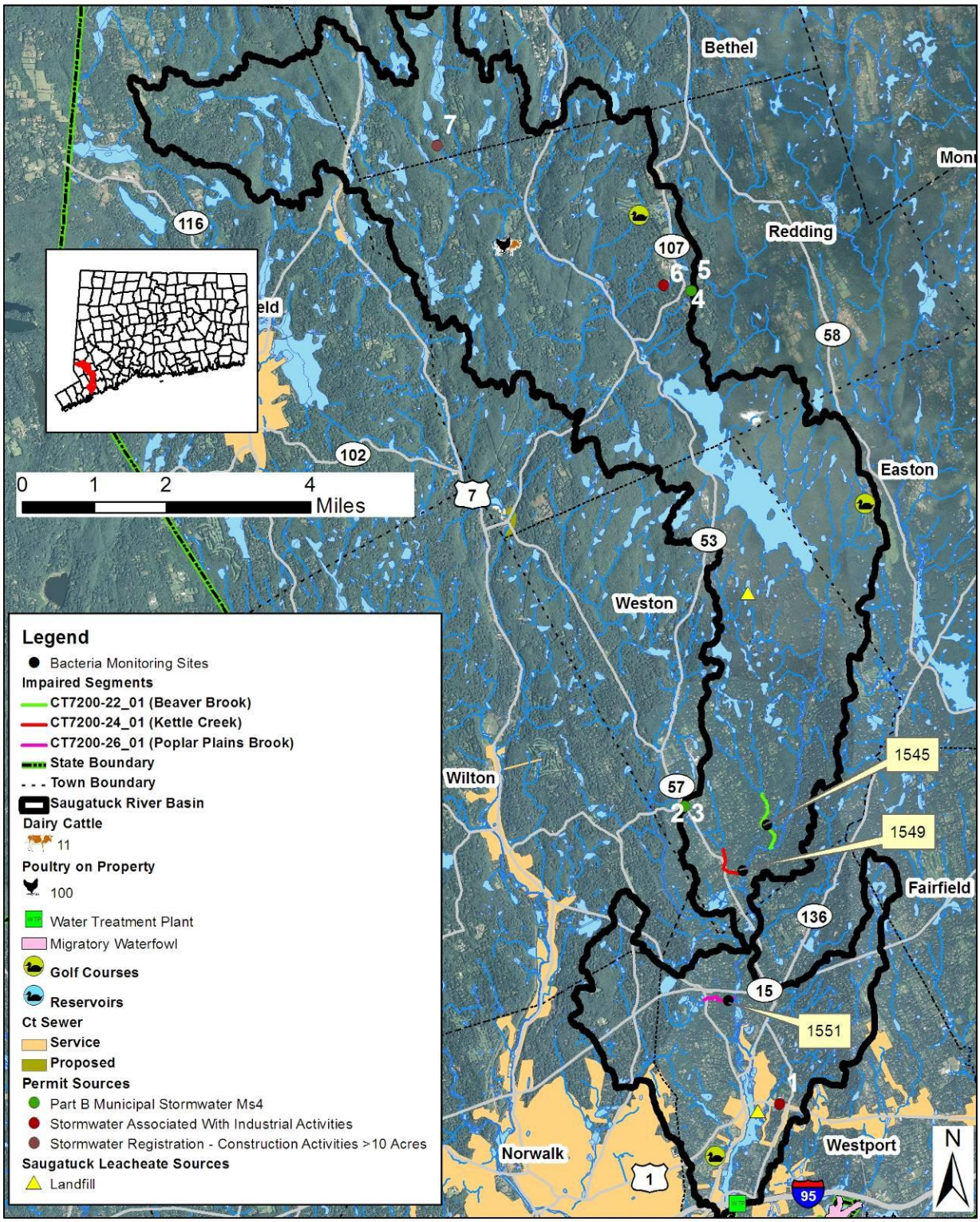
POTENTIAL BACTERIA SOURCES

Potential sources of indicator bacteria in a watershed include point and non-point sources, such as stormwater runoff, agriculture, sanitary sewer overflows (collection system failures), illicit discharges, and inappropriate discharges to the waterbody. Potential sources that have been tentatively identified in the Saugatuck River watershed based on land use (Figures 3 and 4) and a collection of local information for each of the waterbodies is presented in Table 3 below and shown in Figure 9. However, the list of potential sources is general in nature and should not be considered comprehensive. There may be other sources not listed here that contribute to the observed water quality impairment in the study segments. Further monitoring and investigation will confirm listed sources and discover additional sources. Some segments in this watershed are currently listed as unassessed by CT DEEP procedures. This does not mean that there are no data nor that there are no impairments in existence in the segment. In some of these segments there are data from permitted sources and CT DEEP recommends that any elevated concentrations found from those permitted sources be addressed through voluntary reduction measures. More detailed evaluation of potential sources is expected to become available as activities are conducted to implement these TMDLs.

Table 3: Potential bacteria sources in the Saugatuck River watershed

Impaired Segment	Permit Source	Illicit Discharge	CSO/SSO Issue	Failing Septic System	Agricultural Activity	Stormwater Runoff	Nuisance Wildlife/ Pets	Other
Beaver Brook CT7200-22_01	**x**			**x**		**x**	**x**	
Kettle Creek CT7200-24_01	**x**			**x**		**x**	**x**	
Poplar Plain Brook CT7200-26_01	**x**			**x**		**x**	**x**	

Figure 8: Potential sources in the Saugatuck River watershed at the sub-regional level



Potential Bacteria Sources In The Saugatuck River Sub Regional Basin

Map Data: CT DEEP Map Created: July 2011

Point Sources

Permitted sources existing within the watershed that could potentially contribute to the bacteria loading are identified in Table 4. This table includes permit types that may or may not be present in the impaired watershed. A list of active permits in the watershed is included in Table 5. Additional investigation and monitoring could reveal the presence of additional discharges in the watershed. Available effluent data from each of these permitted categories found within the watershed are compared to the CT State WQS for the appropriate receiving waterbody use and type. When available, bacteria data results from these permitted sources are listed in Tables 6 - 8.

Table 4: General categories list of other permitted discharges

Permit Code	Permit Description Type	Number in watershed
CT	Surface Water Discharges	0
GPL	Discharge of Swimming Pool Wastewater	0
GSC	Stormwater Discharge Associated with Commercial Activity	0
GSI	Stormwater Associated with Industrial Activity	2
GSM	Part B Municipal Stormwater MS4	4
GSN	Stormwater Registration – Construction	1
LF	Groundwater Permit (Landfill)	0
UI	Underground Injection	0

Permitted Sources

As shown in Table 5, there are multiple permitted discharges in the Saugatuck River watershed. Bacteria data from 2001 – 2002 and 2006 from many of these industrial permitted facilities are included in Table 6. This data cannot be compared to a water quality standard as Connecticut does not have a water quality standard to evaluate recreation use for fecal coliform bacteria.

Since the MS4 permits are not targeted to a specific location, but the geographic area of the regulated municipality, there is no one accurate location on the map to display the location of these permits. One dot will be displayed at the geographic center of the municipality as a reference point. Sometimes this location falls outside of the targeted watershed and therefore the MS4 permit will not be displayed in the Potential Sources Map. Using the municipal border as a guideline will show which areas of an affected watershed are covered by an MS4 permit.

Table 5: Permitted facilities within the Saugatuck River watershed

Town	Client	Permit ID	Permit Type	Site Name/Address	Map #
Danbury	Blt Reserve, Llc	GSN002208	Stormwater Registration - Construction Activities >10 Acres	Reserve - Phase 5 (Parcel 13)	7
Redding	Town Of Redding	GSM000085	Part B Municipal Stormwater MS4	Redding, Town Of	N/A
Redding	Town Of Redding	GSI000149	Stormwater Associated With Industrial Activities	Redding Highway Department	6
Weston	Town Of Weston	GSM000106	Part B Municipal Stormwater MS4	Weston, Town Of	N/A
Westport	Dattco, Inc.	GSI002101	Stormwater Associated With Industrial Activities	Dattco, Inc.	1
Westport	Town of Westport	GSM000026	Part B Municipal Stormwater MS4	Westport, Town of	N/A

Table 6: Industrial permits in the Saugatuck River watershed and available fecal coliform data (colonies/100mL). The result cannot be compared to the water quality standard as there is no recreation standard for fecal coliform.

Town	Location	Permit Number	Permit Type	Receiving Water	Sample Location	Sample Date	Result
Westport	Town of Westport-DPW	GSI1207	Stormwater Associated with Industrial Activities		CB in the NE001 corner	11/05/02	5
Westport	Town of Westport DPW	GSI1207	Stormwater Associated with Industrial Activities		force main dis @ CB in the NE 001 corner of site	10/15/01	150
Westport	Saugatuck Harbor Yacht Club	GSI347	Stormwater Associated with Industrial Activities	Saugatuck River	Hauling Site	10/26/02	0
Westport	CRRA-Westport Transfer Station	GSI168	Stormwater Associated with Industrial Activities	Mill Creek	Outfall 001	08/29/02	10
Westport	CRRA-Westport Transfer Station	GSI168	Stormwater Associated with Industrial Activities	Mill Creek	Outfall 001	09/25/01	600
Westport	CRRA-Westport Transfer Station	GSI168	Stormwater Associated with Industrial Activities	Mill Creek	Outfall 00A	01/15/01	50

Municipal Stormwater Permitted Sources

The impaired segments in the Saugatuck River watershed are located within the Towns of, Weston and Westport, CT. Both towns have designated urban areas, as defined by the U.S. Census Bureau and are required to comply with the General Permit for the Discharge of Stormwater from Small Municipal Storm Sewer Systems (MS4 permit) issued by the Connecticut Department of Energy and Environmental Protection (DEEP) (Figure 10). This general permit is only applicable to municipalities that are identified in Appendix A of the MS4 permit that contain designated urban areas and discharge stormwater via a separate storm sewer system to surface waters of the State. The permit requires municipalities to develop a Stormwater Management Plan (SMP) to reduce the discharge of pollutants as well as to protect water quality. The MS4 permit is discussed further in the "TMDL Implementation Guidance" section of the core TMDL document. Additional information regarding stormwater management and the MS4 permit can be obtained on CTDEEP's website (www.ct.gov/dep/stormwater).

MS4 outfalls have been sampled for *E. coli* bacteria in the watershed (Table 7). Only a limited set of data, one result, is available from Westport. Additional municipalities may have information on their MS4 outfalls, but there were no impaired segments within the borders so that MS4 information is not included in this TMDL document.

Per the EPA Phase II Stormwater rule all municipal storm sewer systems (MS4s) operators located within US Census Bureau Urbanized Areas (UAs) must be covered under MS4 permits regulated by the appropriate State agency. There is an EPA waiver process that municipalities can apply for to not participate in the MS4 program. In Connecticut, EPA has granted such waivers to 19 municipalities. All participating municipalities within UAs in Connecticut are currently regulated under MS4 permits by CT DEEP staff in the MS4 program.

The US Census Bureau defines a UA as a densely settled area that has a census population of at least 50,000. A UA generally consists of a geographic core of block groups or blocks that exceeds the 50,000 people threshold and has a population density of at least 1,000 people per square mile. The UA will also include adjacent block groups and blocks with at least 500 people per square mile. A UA consists of all or part of one or more incorporated places and/or census designated places, and may include additional territory outside of any place. (67 FR 11663)

For the 2000 Census a new geographic entity was created to supplement the UA blocks of land. This created a block known as an Urban Cluster (UC) and is slightly different than the UA. The definition of a UC is a densely settled area that has a census population of 2,500 to 49,999. A UC generally consists of a geographic core of block groups or blocks that have a population density of at least 1,000 people per square mile, and adjacent block groups and blocks with at least 500 people per square mile. A UC consists of all or part of one or more incorporated places and/or census designated places; such a place(s) together with adjacent territory; or territory outside of any place. The major difference is the total population cap of 49,999 people for a UC compared to >50,000 people for a UA. (67 FR 11663)

While it is possible that CT DEEP will be expanding the reach of the MS4 program to include UC municipalities in the near future they are not currently under the permit. However, the GIS layers used to create the MS4 maps in this Statewide TMDL did include both UA and UC blocks. This factor creates some municipalities that appear to be within an MS4 program that are not currently regulated through an MS4 permit. This oversight can explain a municipality that is at least partially shaded grey in the maps and there are no active MS4 reporting materials or information included in the appropriate appendix. While these areas are not technically in the MS4 permit program, they are still considered urban by the cluster definition above and are likely to contribute similar stormwater discharges to affected waterbodies covered in this TMDL.

As previously noted, EPA can grant a waiver to a municipality to preclude their inclusion in the MS4 permit program. One reason a waiver could be granted is a municipality with a total population less than 1000 people, even if the municipality was located in a UA. There are 19 municipalities in Connecticut that have received waivers, this list is: Andover, Bozrah, Canterbury, Coventry, East Hampton, Franklin, Haddam, Killingworth, Litchfield, Lyme, New Hartford, Plainfield, Preston, Salem, Sherman, Sprague, Stafford, Washington, and Woodstock. There will be no MS4 reporting documents from these towns even if they are displayed in an MS4 area in the maps of this document.

The list of US Census UCs is defined by geographic regions and is named for those regions, not necessarily by following municipal borders. In Connecticut the list of UCs includes blocks in the following Census Bureau regions: Colchester, Danielson, Lake Pocotopaug, Plainfield, Stafford, Storrs, Torrington, Willimantic, Winsted, and the border area with Westerly, RI (67 FR 11663). Any MS4 maps showing these municipalities may show grey areas that are not currently regulated by the CT DEEP MS4 permit program.

The impaired segment of Cobbs Mill Brook is located in the Town of Weston. As mentioned above, Weston is considered an Urban Cluster (UC), and has no urbanized areas as defined by the U.S. Census Bureau. Therefore, Weston is not an MS4 area and is not required to comply with the General Permit for the Discharge of Stormwater from Small Municipal Storm Sewer Systems (MS4 permit) issued by CT DEEP (Figure 9). Information regarding stormwater management and the MS4 permit can be obtained on CTDEEP's website (http://www.ct.gov/dep/cwp/view.asp?a=2721&q=325702&depNav_GID=1654).

Figure 9: MS4 areas of the Saugatuck River watershed

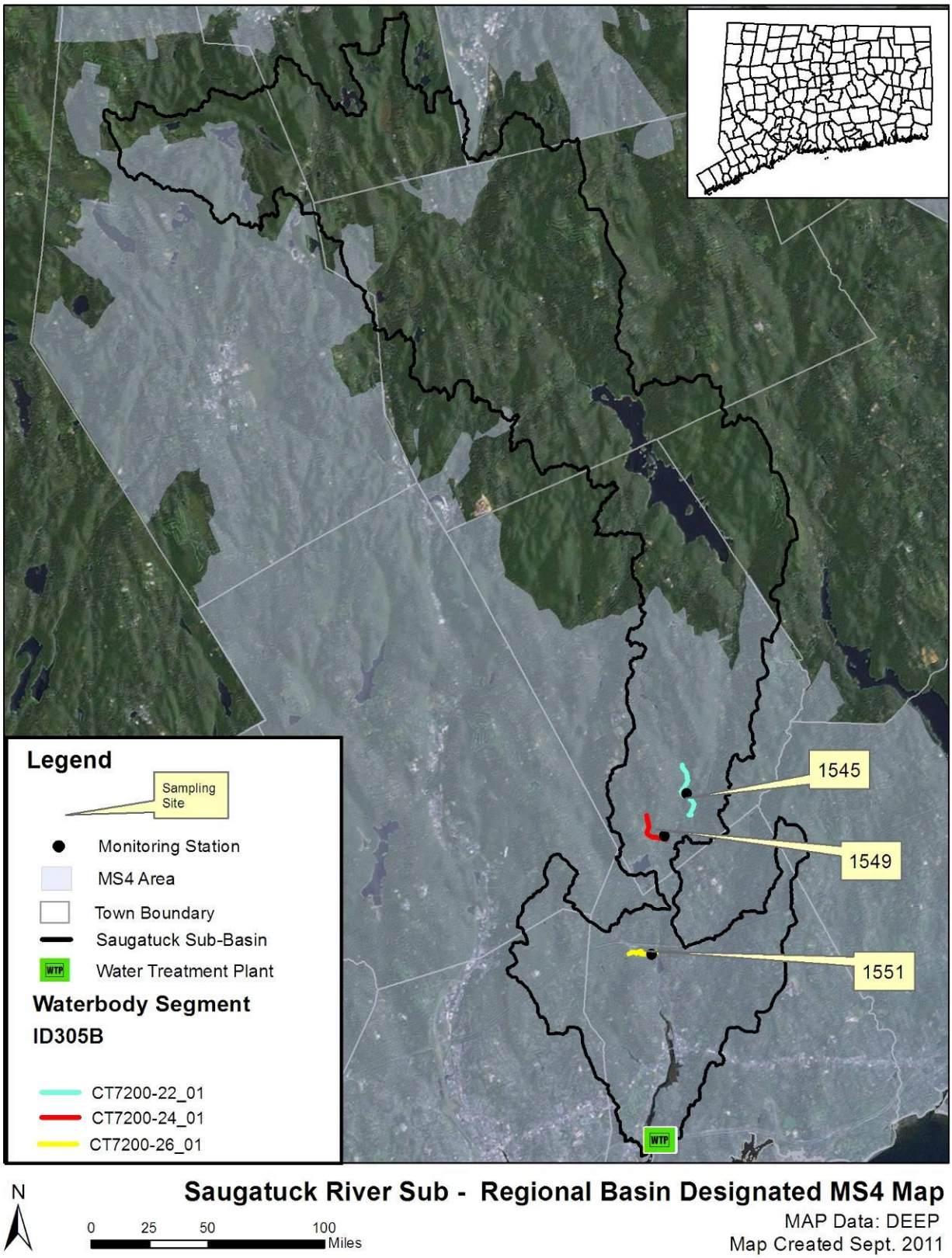


Table 7: List of MS4 sample locations and *E. coli* (colonies/100 mL) results in the Saugatuck River watershed

Town	Location	MS4 Type	Receiving Water	Sample Date	Result
Westport	Harbor hill @ Imperial Avenue	Residential	Saugatuck River	09/15/05	-
Westport	Woodcock Road & Grouse Path	Residential	Poplar Plains Brook	09/14/06	10
Westport	Woodcock Road & Grouse Path	Residential	Poplar Plains Brook	09/15/05	-
Weston	High School outfall	Commercial	Saugatuck River	9/27/2010	>2419.6
Weston	Middle School outfall	Commercial	Saugatuck River	9/27/2010	12
Weston	Old Orchard Drive off Godfrey Road	Residential	Saugatuck River	9/27/2010	18.5
Weston	High School outfall	Commercial	Saugatuck River	10/15/2010	298.7
Weston	Middle School outfall	Commercial	Saugatuck River	10/15/2010	1732.9
Weston	Old Orchard Drive off Godfrey Road	Residential	Saugatuck River	10/15/2010	980.4
Weston	High School outfall	Commercial	Saugatuck River	11/4/2010	127.4
Weston	Middle School outfall	Commercial	Saugatuck River	11/4/2010	>2419.6
Weston	Old Orchard Drive off Godfrey Road	Residential	Saugatuck River	11/4/2010	>2419.6
Weston	High School outfall	Commercial	Saugatuck River	8/25/2011	24.3
Weston	Middle School outfall	Commercial	Saugatuck River	8/25/2011	1299.7
Weston	behind post office/grocery store RT 57	Commercial	Saugatuck River	8/25/2011	816.4
Weston	Lords Highway	Residential	Saugatuck River	8/25/2011	1986.3
Weston	Codfish Lane near Old Redding Road	Residential	Saugatuck River	8/25/2011	30.1
Shaded cells indicate an exceedance of single-sample based water quality criteria (410 colonies/100 mL)					

Publicly Owned Treatment Works

As shown in Figures 9 and 10, there is one publicly owned treatment works (POTWs), or wastewater treatment plant, in the Saugatuck River watershed. The Westport Water Treatment Plant is located in the southern portion of the watershed and discharges to the Saugatuck River, downstream of the impaired segment. Bacteria data from the discharge of the Westport Water Treatment Plant are included in Table 8. The plant did not exceed its permit limits on any date sampled.

Table 8: Wastewater treatment plant Fecal Coliform (colonies/100 mL) data discharging to the Saugatuck River

Town	Permittee	Permit Number	Receiving Water	Date	30-Day Geometric Mean	7-Day Geometric Mean
Westport	Westport WPCF	CT0100684	Saugatuck River	01/31/2009	1.82	3
Westport	Westport WPCF	CT0100684	Saugatuck River	02/28/2009	1.3	3
Westport	Westport WPCF	CT0100684	Saugatuck River	03/31/2009	2.59	4
Westport	Westport WPCF	CT0100684	Saugatuck River	04/30/2009	2.62	6
Westport	Westport WPCF	CT0100684	Saugatuck River	05/31/2009	3.17	7
Westport	Westport WPCF	CT0100684	Saugatuck River	06/30/2009	1.89	4
Westport	Westport WPCF	CT0100684	Saugatuck River	07/31/2009	2.58	10
Westport	Westport WPCF	CT0100684	Saugatuck River	08/31/2009	6.44	26
Westport	Westport WPCF	CT0100684	Saugatuck River	09/30/2009	9.72	35
Westport	Westport WPCF	CT0100684	Saugatuck River	10/31/2009	3.77	13
Westport	Westport WPCF	CT0100684	Saugatuck River	11/30/2009	3.05	6
Westport	Westport WPCF	CT0100684	Saugatuck River	12/31/2009	1.76	4
Westport	Westport WPCF	CT0100684	Saugatuck River	01/31/2010	2.58	11
Westport	Westport WPCF	CT0100684	Saugatuck River	02/28/2010	4.19	27
Westport	Westport WPCF	CT0100684	Saugatuck River	03/31/2010	1.44	3
Westport	Westport WPCF	CT0100684	Saugatuck River	04/30/2010	1.42	4
Westport	Westport WPCF	CT0100684	Saugatuck River	05/31/2010	3.51	22
Westport	Westport WPCF	CT0100684	Saugatuck River	06/30/2010	3.31	15
Westport	Westport WPCF	CT0100684	Saugatuck River	07/31/2010	4.48	13
Westport	Westport WPCF	CT0100684	Saugatuck River	08/31/2010	3.25	17
Westport	Westport WPCF	CT0100684	Saugatuck River	09/30/2010	6.15	37
Westport	Westport WPCF	CT0100684	Saugatuck River	10/31/2010	5.79	30
Westport	Westport WPCF	CT0100684	Saugatuck River	11/30/2010	2.88	25
Westport	Westport WPCF	CT0100684	Saugatuck River	12/31/2010	3.58	7
Westport	Westport WPCF	CT0100684	Saugatuck River	01/31/2011	3.84	25
Westport	Westport WPCF	CT0100684	Saugatuck River	02/28/2011	2.36	31
Westport	Westport WPCF	CT0100684	Saugatuck River	03/31/2011	4.12	8
Westport	Westport WPCF	CT0100684	Saugatuck River	04/30/2011	2.25	4
Westport	Westport WPCF	CT0100684	Saugatuck River	05/31/2011	2.22	5
Westport	Westport WPCF	CT0100684	Saugatuck River	06/30/2011	2.23	5
Westport	Westport WPCF	CT0100684	Saugatuck River	07/31/2011	2.94	15
Westport	Westport WPCF	CT0100684	Saugatuck River	08/31/2011	5.41	13
Westport	Westport WPCF	CT0100684	Saugatuck River	09/30/2011	3.7	10
30-Day Geometric Mean Permit Limit = 200 colonies/100 mL **7-Day Geometric Mean Permit Limit = 400 colonies/100 mL**						

Non-point Sources

Non-point source pollution (NPS) comes from many diffuse sources and is more difficult to identify and control. NPS pollution is often associated with land-use practices. Examples of NPS that can contribute bacteria to surface waters include insufficient septic systems, pet and wildlife waste, agriculture, and contract recreation (swimming or wading). Potential sources of NPS within the Saugatuck River watershed are described below. The 2006 Saugatuck River Watershed Based Plan describes many of these sources in greater detail http://www.swrpa.org/Default.aspx?Regional=280.

Insufficient Septic Systems

As shown in Figure 9, only a small portion in the southern section of the watershed relies on the municipal sewer system. The majority of the watershed including the area surrounding the impaired segments relies on onsite wastewater treatment systems, such as septic systems. Insufficient or failing septic systems can be significant sources of bacteria by allowing raw waste to reach surface waters.

In Connecticut, local health directors or health districts are responsible for keeping track of any reported insufficient of failing septic systems in a specific municipality. Weston and Westport are part of the Westport-Weston health district (http://www.wwhd.org/).

Wildlife and Domestic Animal Waste

Wildlife and domestic animals within the Saugatuck River watershed represent another potential source of bacteria to the impaired waterbodies. Wildlife, including waterfowl, may be a significant bacteria source to surface waters. Any elevated bacteria levels that are due solely to a natural population of wildlife are not subject to the WQS. Any exacerbation of wildlife population sizes or residency times influenced by human activities are subject to the CT WQS and TMDL provisions.

With the construction of roads and drainage systems, these wildlife wastes may no longer be retained on the landscape, but instead may be conveyed via stormwater to the nearest surface waterbody. As such these physical land alterations can exacerbate the impact of these natural sources on water quality (USEPA, 2001). As the majority of the watershed is undeveloped, wildlife waste is a potential source of bacteria in the Saugatuck River watershed.

Geese and other waterfowl are known to congregate in open areas including recreational fields, agricultural crop fields, and golf courses. In addition to creating a nuisance, large numbers of geese can also create unsanitary conditions on the grassed areas and cause water quality problems due to bacterial contamination associated with their droppings. Large populations of geese can also lead to habitat destruction as a result of overgrazing on wetland and riparian plants.

Much of the residential development in the watershed is located near Beaver Brook, Kettle Creek, and Poplar Plain Brook. Waste from domestic animals such as dogs, may also be contributing to bacteria concentrations in these impaired segments in the Saugatuck River watershed.

Agricultural Activities

Agricultural operations are an important economic activity and landscape feature in many areas of the state. Runoff from agricultural fields may contain pollutants such as bacteria and nutrients (USEPA, 2011a). Though agricultural land use makes up only 2% of the Saugatuck River watershed, multiple agricultural fields and livestock farms are located near the northern section of the watershed (Figure 4). For example, there is a large farm on Gallows Hill Road in Redding that has various forms of livestock,

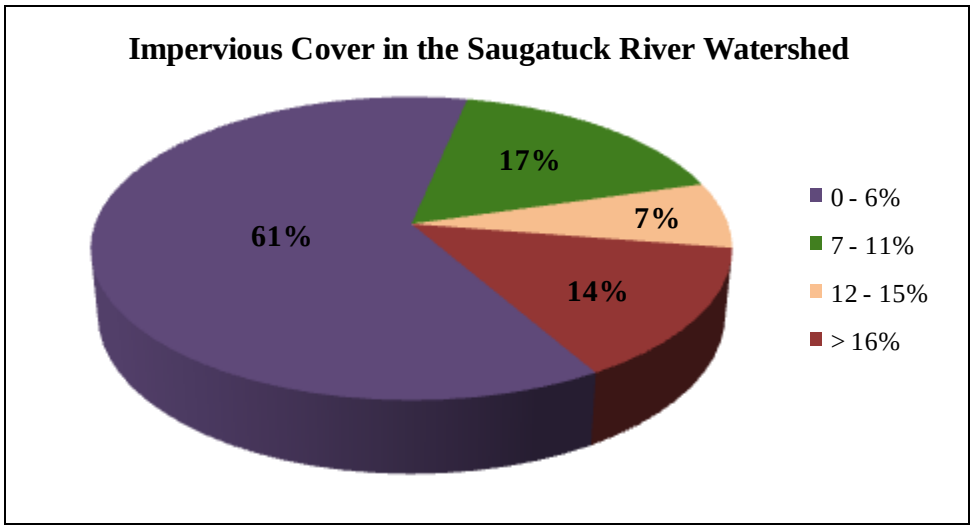
including chickens and cows, as well as vegetable fields. In West Redding, there is a 102-acre dairy farm and environmental education center. Agricultural runoff from farms in the area is a potential source of bacteria to the watershed.

Stormwater Runoff from Developed Areas

The majority of the Saugatuck River watershed is undeveloped. However, approximately 28% of the land use in the watershed is considered urban, and this area is concentrated around the impaired segments, Beaver Brook, Kettle Creek, and Poplar Plain Brook (Figures 4 and 12). Urban areas are often characterized by impervious cover, or surface areas such as roofs and roads that force water to run off land surfaces rather than infiltrate into the soil. Past studies have shown a link between the amount of impervious area in a watershed and water quality conditions (CWP, 2003). In one study, researchers correlated the amount of fecal coliform to the percent of impervious cover in a watershed (Mallin et. al., 2000).

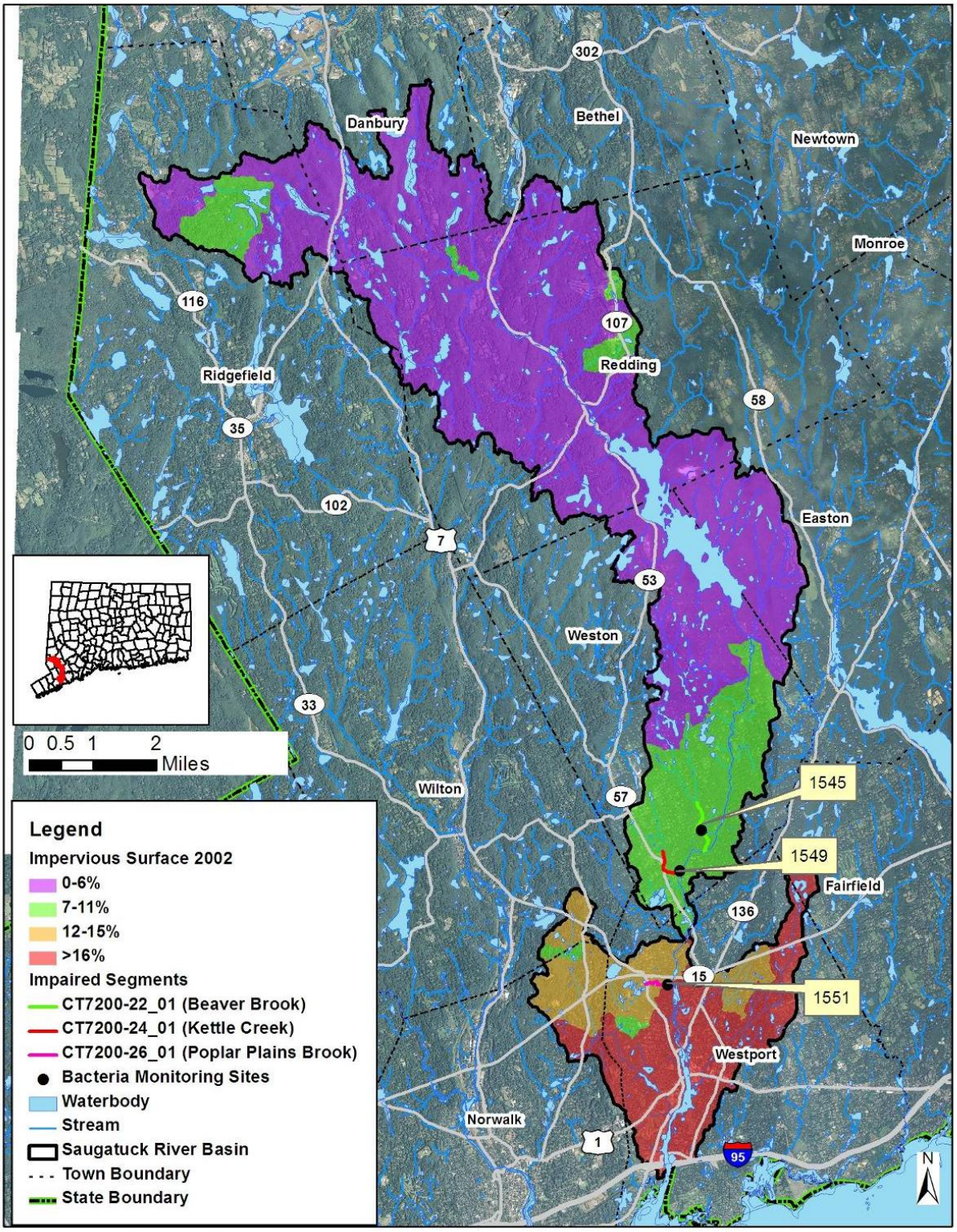
The majority of the Saugatuck River watershed has less than 6% impervious surfaces (Figure 11). However, portions of the watershed near the southern section of the watershed have a higher percentage of impervious cover (Figure 12). In particular, the area surrounding Poplar Plain Brook has an impervious cover consistently above 12% indicating that stormwater runoff may be a source of bacteria to the this impaired segment (Figure 12).

Figure 10: Range of impervious cover (%) in the Saugatuck River watershed



High wet weather geometric means may indicate that stormwater runoff is contributing to the bacterial impairment in a river segment. As shown in Tables 12 and 14, the geometric mean for wet weather exceeded the WQS on Beaver Brook and Poplar Plain Brook. As the areas surrounding these stations are heavily developed (Figure 9), these segments are likely receiving bacteria from stormwater runoff.

Figure 11: Impervious cover (%) for the Saugatuck River sub-regional watershed



Impervious Surface In The Saugatuck River Sub Regional Basin

Map Data: CT DEEP Map Created: July 2011

Additional Sources

There may be other sources not listed here or identified in Figure 8 which contribute to the observed water quality impairment in the Saugatuck River watershed. Further monitoring and investigation will confirm the listed sources and discover additional ones. More detailed evaluation of potential sources is expected to become available as activities are conducted to implement this TMDL.

Land Use/Landscape

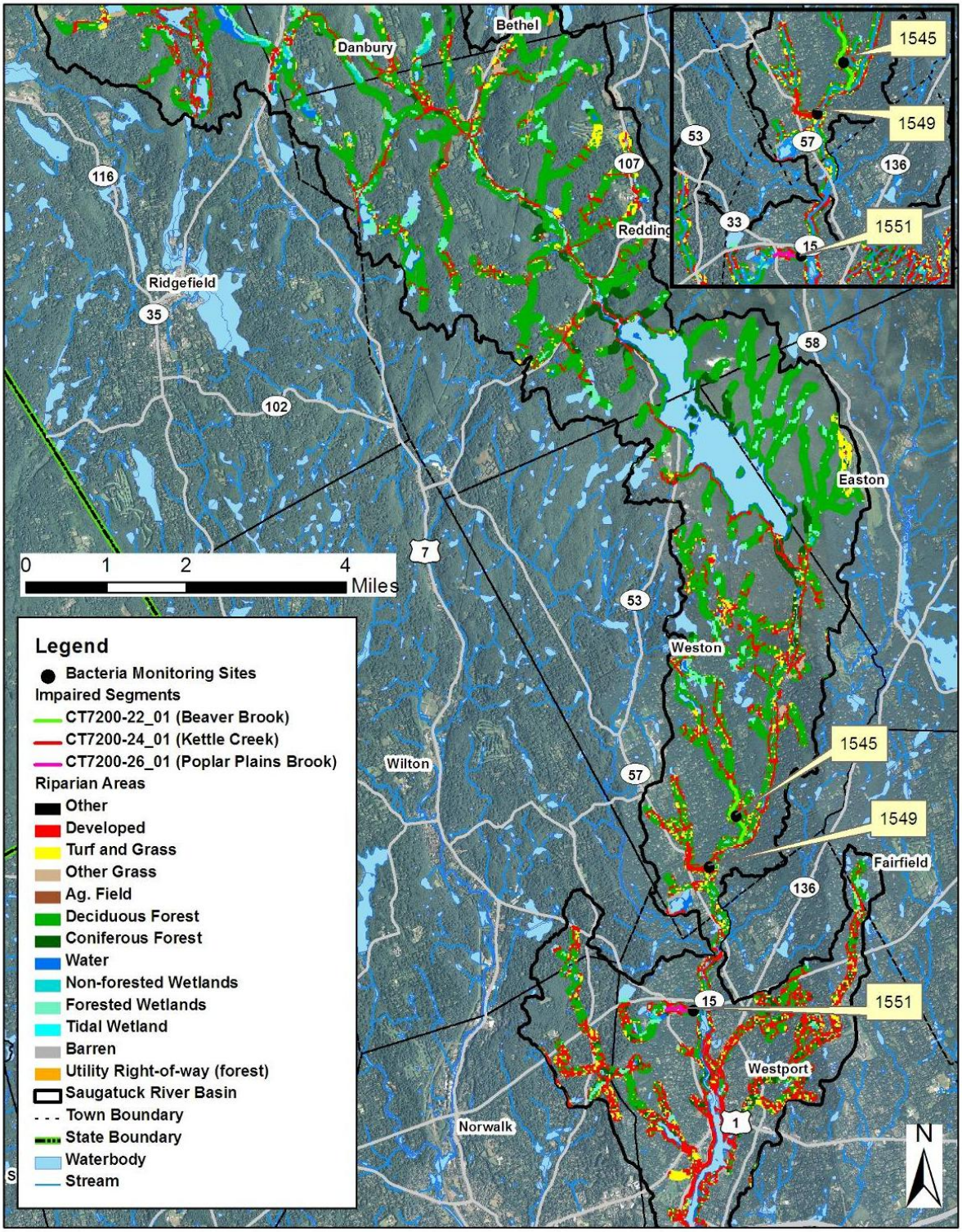
Riparian Buffer Zones

The riparian buffer zone is the area of land located immediately adjacent to streams, lakes, or other surface waters. The boundary of the riparian zone and the adjoining uplands is gradual and not always well-defined. However, riparian zones differ from the uplands because of high levels of soil moisture, frequent flooding, and the unique assemblage of plant and animal communities found there. Through the interaction of their unique soils, hydrology, and vegetation, natural riparian areas influence water quality as contaminants are taken up into plant tissues, adsorbed onto soil particles, or modified by soil organisms. Any change to the natural riparian buffer zone can reduce the effectiveness of the natural buffer and has the potential to contribute to water quality impairment (USEPA, 2011b).

The CLEAR program at UCONN has created streamside buffer layers for the entire State of Connecticut (http://clear.uconn.edu/) which have been used in this TMDL. Analyzing this information can reveal potential sources and implementation opportunities at a localized level. The land use directly adjacent to a waterbody can have direct impacts on water quality from surface runoff sources.

The riparian zones for the impaired segment of Beaver Brook, and Kettle Creek are characterized by forested areas (Figure 12). As previously noted, waste from wildlife in non-developed areas can contribute bacteria to nearby waterbodies, though much of this waste may be treated by the natural vegetated buffer. The riparian zone for Poplar Plain Brook is predominately developed (Figure 12). Developed areas within the riparian zone likely contribute pollutants such as bacteria to the waterbody and indicate that the natural riparian buffer is not available to treat this runoff.

Figure 12: Riparian buffer zone information for the Saugatuck River watershed



Riparian Areas In The Saugatuck River Sub Regional Basin

UCONN CLEAR: http://clear.uconn.edu/ Map Data: DEEP Map Created: October 2011

CURRENT MANAGEMENT ACTIVITIES

The Towns of Weston and Westport have developed and implemented programs to protect water quality from bacterial contamination. In 2006, the Saugatuck River Watershed Based Plan was completed (http://www.swrpa.org/Default.aspx?Regional=280). This document outlines current actions in the watershed and recommends future actions necessary to maintain or improve water quality.

CT DEEP's Non-Point Source Pollution Program administers a Non-Point Source Grant Program with funding from EPA under Section 319 of the Clean Water Act (319 grant). A 319 grant was awarded in the watershed in 2006 to provide seasonal water quality baselines through weekly bacteria sampling at 18 sampling sites within the Saugatuck River watershed (http://www.depdata.ct.gov/maps/nps/npsmap.htm). Much of the data used in this TMDL was collected by the recipients of the 319 grant dollars.

As indicated previously, Weston and Westport are regulated under the MS4 program. The MS4 General Permit is required for any municipality with urbanized areas that initiates, creates, originates or maintains any discharge of stormwater from a storm sewer system to waters of the state. The MS4 permit requires towns to design a Stormwater Management Plan (SMP) to reduce the discharge of pollutants in stormwater to improve water quality. The plan must address the following 6 minimum measures:

1. Public Education and Outreach.
2. Public Involvement/Participation.
3. Illicit discharge detection and elimination.
4. Construction site stormwater runoff control.
5. Post-construction stormwater management in the new development and redevelopment.
6. Pollution prevention/good housekeeping for municipal operations.

Each town is also required to submit an annual update outlining the steps they are taking to meet the six minimum measures. All updates that address bacterial contamination in the watershed are summarized in Tables 9 and 10. In addition to the updates listed in the tables, the Town of Weston sampled six stormwater outfalls during wet weather.

Table 9: Summary of MS4 requirement updates related to the reduction of bacterial contamination from Weston, CT (Permit # GSM000106)

Minimum Measure	Weston Annual Report Update (2010)
Public Outreach and Education	1) Webpage updated to include annual report. 2) Educational brochures on the water quality impacts of residential stormwater were made available the town hall and library. 3) Brochures will be distributed in tax bill (2011).
Public Involvement and Participation	1) Continued implementation of stormwater hotline.
Illicit Discharge Detection and Elimination	1) Illicit discharge ordinance is planned for adoption in 2011. 2) Continued use of as-built drawings of all stormwater systems in town.
Construction Site Stormwater Runoff Control	1) Adopted a new Zoning Ordinance in 2009.
Post Construction Stormwater management	1) Three detention basins were inspected and cleaned if needed (Old Orchard Drive, Old Farm Road, and Freeborn Road at Old Redding Road).
Pollution Prevention and Good Housekeeping	1) DPW staff did not attend stormwater training this year due to budget constraints. 2) All town-owned streets were swept at least once in 2010. 3) All town-owned catch basins were inspected and cleaned if needed.

Table 10: Summary of MS4 requirement updates related to the reduction of bacterial contamination from Westport, CT (Permit # GSM000026)

Minimum Measure	Westport Annual Report Update (2010)
Public Outreach and Education	1) Utilizes the town website to post information about the Phase II program. 2) Educational information about the Phase II program is posted on a bulletin board outside the Public Works office.
Public Involvement and Participation	No updates
Illicit Discharge Detection and Elimination	1) Mapped all outfalls 12" and larger.
Construction Site Stormwater Runoff Control	1) Conservation and Zoning enforcement officers have incorporated sediment and erosion control inspections and enforcement into their job responsibilities.
Post Construction Stormwater management	1) Insists all development and redevelopment projects consider water quality in their design.
Pollution Prevention and Good Housekeeping	1) All town-owned streets were swept at least once in 2009. 2) All town-owned catch basins were inspected and cleaned if needed.

RECOMMENDED NEXT STEPS

The Towns of Weston and Westport have developed and implemented programs to protect water quality from bacterial contamination. Future mitigative activities are necessary to ensure the long-term protection of, Beaver Brook, Kettle Creek, and Poplar Plain Brook and have been prioritized below. Some of these actions are provided in more detail in the 2006 Saugatuck River Watershed Based Plan (http://www.ct.gov/dep/cwp/view.asp?A=2719&Q=379296).

1) Continue monitoring of permitted sources.

Previous sampling of discharge from permitted sources within the watershed has shown elevated levels of *E. coli* or fecal coliform bacteria, indicators of bacterial pollution (Tables 6 - 8). If any current monitoring is not done with appropriate bacterial indicator based on the receiving water, then a recommended change during the next permit reissuance is to include the appropriate indicator species. If facility monitoring indicates elevated bacteria, then implementation of permit required, and voluntary measures to identify and reduce sources of bacterial contamination at the facility is an additional recommendation. Regular monitoring should continue on all permitted sources to ensure compliance with permit requirements and to determine if current requirements are adequate or if additional measures are necessary for water quality protection.

Section 6(k) of the MS4 General Permit requires a municipality to modify their Stormwater Management Plan to implement the TMDL within 4 months of TMDL approval by EPA if stormwater within the municipality contributes pollutant(s) in excess of the allocation established within the TMDL. For the discharges to the impaired waterbody, the municipality must assess the six minimum measures of its plan and modify the plan to implement additional, necessary controls for each appropriate measure. Particular focus should be placed on the following plan components: public education program, illicit discharge detection and elimination, stormwater structures cleaning, priority for the repair, upgrade, or retrofit of storm sewer structures. The goal of the modifications is to establish a program to improve water quality consistent with the requirements of the TMDL. Modifications to the Stormwater Management Plan in response to TMDL development should be submitted to the Stormwater Program of DEEP for review and approval. Table 11 details the appropriate waste load allocations established by this TMDL for use as water quality targets for permittees as permits are renewed and updated, within the Saugatuck River Watershed.

For any municipality subject to an MS4 permit and affected by a TMDL, the permit requires a modification of the SMP to include BMPs that address the included impairment. In the case of bacteria related impairments municipal BMPs could include: implementation or improvement to existing nuisance wildlife programs, septic system monitoring programs, any additional measures that can be added to the required illicit discharge detection and elimination (IDDE) programs, and increased street sweeping above basic permit requirements. Any non-MS4 municipalities can implement these same types of initiatives in effort to reduce bacteria source loading to impaired waterways.

Any facilities that discharge non-MS4 regulated stormwater should update their Pollution Prevention Plan to reflect BMPs that can reduce bacteria loading to the receiving waterway. These BMPs could include nuisance wildlife control programs and any installations that increase surface infiltration to reduce overall stormwater volumes. Facilities that are regulated under the Commercial Activities Stormwater Permit should report any updates to their SMP in their summary documentation submitted to DEEP.

Table 11. Bacteria (e.coli) TMDLs, WLAs, and LAs for recreation uses

		Instantaneous *E. coli* (#/100mL)						Geometric Mean *E. coli* (#/100mL)	
Class	**Bacteria Source**	**WLA[6]**			**LA[6]**			**WLA[6]**	**LA[6]**
	Recreational Use	**1**	**2**	**3**	**1**	**2**	**3**	**All**	**All**
A	Non-Stormwater NPDES	0	0	0				0	
	CSOs	0	0	0				0	
	SSOs	0	0	0				0	
	Illicit sewer connection	0	0	0				0	
	Leaking sewer lines	0	0	0				0	
	Stormwater (MS4s)	235[7]	410[7]	576[7]				126[7]	
	Stormwater (non-MS4)				235[7]	410[7]	576[7]		126[7]
	Wildlife direct discharge				235[7]	410[7]	576[7]		126[7]
	Human or domestic animal direct discharge[5]				235	410	576		126

(1) **Designated Swimming.** Procedures for monitoring and closure of bathing areas by State and Local Health Authorities are specified in: Guidelines for Monitoring Bathing Waters and Closure Protocol, adopted jointly by the Department of Environmental Protections and the Department of Public Health. May 1989. Revised April 2003 and updated December 2008.

(2) **Non-Designated Swimming.** Includes areas otherwise suitable for swimming but which have not been designated by State or Local authorities as bathing areas, waters which support tubing, water skiing, or other recreational activities where full body contact is likely.

(3) **All Other Recreational Uses.**

(4) Criteria for the protection of recreational uses in Class B waters do not apply when disinfection of sewage treatment plant effluents is not required consistent with Standard 23. (Class B surface waters located north of Interstate Highway I-95 and downstream of a sewage treatment plant providing seasonal disinfection May 1 through October 1, as authorized by the Commissioner.)

(5) Human direct discharge = swimmers

(6) Unless otherwise required by statute or regulation, compliance with this TMDL will be based on ambient concentrations and not end-of-pipe bacteria concentrations

(7) These values can be "as naturally occurs" if the only pollutant source is wildlife. Natural is defined as the biological, chemical and physical conditions and communities that occur within the environment which are unaffected or minimally affected by human influences (CT DEEP 2011a). Sections 2.2.2 and 6.2.7 of this Core Document deal with BMPs and delineating type of wildlife inputs.

2) Identify areas in the more developed sections of the Saugatuck River watershed to implement Best Management Practices (BMPs) to control stormwater runoff.

As noted previously, 28% of the Saugatuck River watershed is considered urban and the towns within the Saugatuck River watershed are MS4 communities regulated by the MS4 program. Portions of the watershed in Weston and Westport have an impervious cover between 7 – 11% and areas near the impaired segment of Poplar Plain Brook have an impervious cover of greater than 12%. As such, stormwater runoff is likely contributing bacteria to the waterbodies, of Beaver Brook, Kettle Creek, and Poplar Plain Brook. Most of the developed areas are located in the Towns of Weston and Westport.

The Saugatuck River Watershed Based Plan (2006) made specific recommendations to reduce the impacts of stormwater runoff on water quality (http://www.swrpa.org/Default.aspx?Regional=280). The plan recommended adopting stormwater ordinances in the watershed and highlighted multiple areas to install structural BMPs. The suggested BMPs within the watershed towns are listed in Table 12.

Table 12: Recommended structural BMPs in Weston, and Westport from the 2006 Saugatuck River Watershed Based Plan

Location	Town	Recommended BMPs
Weston Town Center	Weston	Improve existing wet basin and add bioretention areas.
Weston School Complex	Weston	Series of curb cuts into bioretention areas.
Post Road East	Westport	Series of bioretention areas and a marsh restoration project.
Post Road West	Westport	Naturalized surface basin and a bioretention area.

To identify other areas that are contributing bacteria to the impaired segments, the towns should continue to conduct wet-weather sampling at stormwater outfalls that discharge directly to the impaired segments in the Saugatuck River watershed. Outfalls that have previously shown high bacteria concentrations should be prioritized for BMP installation (Table 7). To treat stormwater runoff, the towns should identify areas along the more developed sections of the impaired segments to install BMPs designed to encourage stormwater to infiltrate into the ground before entering the waterbodies. These BMPs would disconnect impervious areas and reduce pollutant loads to the river. More detailed information and BMP recommendations can be found in the core TMDL document.

3) Evaluate the municipalities' education and outreach programs regarding animal waste.

As most of the Saugatuck River watershed is undeveloped, any education and outreach program should highlight the importance of not feeding waterfowl and wildlife and picking up after horses, dogs, and other pets. The town and residents can take measures to minimize waterfowl-related impacts such as allowing tall, coarse vegetation to grow in the riparian areas of the impaired segments that are frequented by waterfowl. Waterfowl, especially grazers like geese, prefer easy access to water. Maintaining an uncut vegetated buffer along the shore will make the habitat less desirable to geese and encourage migration. In addition, any educational program should emphasize that feeding waterfowl, such as ducks, geese, and swans, may contribute to water quality impairments in the Saugatuck River watershed and can harm human health and the environment.

Animal wastes should be disposed of away from any waterbody or storm drain system. BMPs effective at reducing the impact of animal waste on water quality include installing signage, providing pet waste receptacles in high-uses areas, enacting ordinances requiring the clean-up of pet waste, and targeting educational and outreach programs in problem areas.

4) Develop a system to monitor septic systems.

Though a small portion of the residents within the Saugatuck River watershed rely on the municipal sanitary sewer system, most residents rely on septic systems. If not already in place, Weston, and Westport should establish a program to ensure that existing septic systems are properly operated and maintained. For instance, communities can create an inventory of existing septic systems through mandatory inspections. Inspections help encourage proper maintenance and identify failed and sub-standard systems. Policies that govern the eventual replacement of the sub-standard systems within a

reasonable timeframe could also be adopted. Towns can also develop programs to assist citizens with the replacement and repair of older and failing systems.

5) Ensure there are sufficient buffers on agricultural lands along the Saugatuck River.

If not already in place, agricultural producers should work with the CT Department of Agriculture and the U.S. Department of Agriculture Natural Resources Conservation Service to develop conservation plans for their farming activities within the watershed. These plans should focus on ensuring that there are sufficient stream buffers, that fencing exists to restrict access to livestock and horses to streams and wetlands, and that animal waste handling, disposal, and other appropriate Best Management Practices (BMPs) are in place.

BACTERIA DATA AND PERCENT REDUCTIONS TO MEET THE TMDL

Table 13: Beaver Brook Bacteria Data

Waterbody ID: CT7200-22_01

Characteristics: Freshwater, Class A, Potential Public Drinking Water Supply, Habitat for Fish and other Aquatic Life and Wildlife, Recreation, Navigation, and Industrial and Agricultural Water Supply

Impairment: Recreation (*E. coli bacteria)*

Water Quality Criteria for E. coli:

Geometric Mean: 126 colonies/100 mL

Single Sample: 410 colonies/100 mL

Percent Reduction to meet TMDL:

Geometric Mean: **37%**

Single Sample: **86%**

Data: 2005 - 2008 from Earthplace sampling efforts, 2012 TMDL Cycle

Single sample *E. coli* data (colonies/100 mL) from Station 1545 on Beaver Brook with annual geometric means calculated

Station Name	Station Location	Date	Results	Wet/Dry	Geomean
1545	Good Hill Road crossing	5/5/2005	27	dry**	30
1545	Good Hill Road crossing	5/19/2005	10	dry	
1545	Good Hill Road crossing	6/2/2005	9	dry	
1545	Good Hill Road crossing	6/16/2005	16	wet	
1545	Good Hill Road crossing	7/7/2005	388	wet	
1545	Good Hill Road crossing	7/21/2005	50	wet	
1545	Good Hill Road crossing	5/4/2006	36	dry	99
1545	Good Hill Road crossing	5/18/2006	48	dry	
1545	Good Hill Road crossing	6/8/2006	900	wet	
1545	Good Hill Road crossing	6/22/2006	180	dry	
1545	Good Hill Road crossing	7/6/2006	780	wet	
1545	Good Hill Road crossing	7/20/2006	300	dry	
1545	Good Hill Road crossing	8/10/2006	16	dry**	
1545	Good Hill Road crossing	8/24/2006	16	dry	
1545	Good Hill Road crossing	9/7/2006	96	dry	
1545	Good Hill Road crossing	9/21/2006	54	dry	

Single sample *E. coli* data (colonies/100 mL) from Station 1545 on Beaver Brook with annual geometric mean calculated (continued)

Station Name	Station Location	Date	Results	Wet/Dry	Geomean
1545	Good Hill Road crossing	5/10/2007	30	dry	**200* (37%)**
1545	Good Hill Road crossing	5/31/2007	20	wet	
1545	Good Hill Road crossing	6/14/2007	250	dry	
1545	Good Hill Road crossing	6/28/2007	140	dry	
1545	Good Hill Road crossing	7/12/2007	156	wet	
1545	Good Hill Road crossing	7/26/2007	132	dry	
1545	Good Hill Road crossing	8/9/2007	**3000* (86%)**	wet	
1545	Good Hill Road crossing	8/23/2007	220	dry**	
1545	Good Hill Road crossing	9/13/2007	1800	dry	
1545	Good Hill Road crossing	5/8/2008	108	dry	62
1545	Good Hill Road crossing	5/22/2008	96	wet	
1545	Good Hill Road crossing	6/26/2008	16	dry	
1545	Good Hill Road crossing	7/10/2008	76	dry	
1545	Good Hill Road crossing	7/31/2008	20	wet	
1545	Good Hill Road crossing	8/14/2008	102	dry**	
1545	Good Hill Road crossing	9/11/2008	108	dry	
1545	Good Hill Road crossing	9/25/2008	80	dry	

Shaded cells indicate an exceedance of water quality criteria

**** Weather conditions for selected data taken from Hartford because local station had missing data**

***Indicates single sample and geometric mean values used to calculate the percent reduction**

Wet and dry weather *E. coli* (colonies/100 mL) geometric mean values for Station 1545 on Beaver Brook

Station Name	Station Location	Years Sampled	Number of Samples		Geometric Mean		
			Wet	Dry	All	Wet	Dry
1545	Good Hill Road crossing	2005-2008	10	23	86	144	69

Shaded cells indicate an exceedance of water quality criteria

Weather condition determined from rain gauges in Danbury, CT and at Hartford Bradley International Airport

Table 14: Kettle Creek Bacteria Data

Waterbody ID: CT7200-24_01

Characteristics: Freshwater, Class A, Potential Public Drinking Water Supply, Habitat for Fish and other Aquatic Life and Wildlife, Recreation, Navigation, and Industrial and Agricultural Water Supply

Impairment: Recreation (*E. coli bacteria)*

Water Quality Criteria for E. coli:

Geometric Mean: 126 colonies/100 mL

Single Sample: 410 colonies/100 mL

Percent Reduction to meet TMDL:

Geometric Mean: **19%**

Single Sample: **82%**

Data: 2005 - 2008 from Earthplace sampling efforts, 2012 TMDL Cycle

Single sample *E. coli* data (colonies/100 mL) from Station 1549 on Kettle Creek with annual geometric mean calculated

Station Name	Station Location	Date	Results	Wet/Dry	Geomean
1549	Good Hill Road crossing	5/5/2005	8	dry**	20
1549	Good Hill Road crossing	5/19/2005	4	dry	
1549	Good Hill Road crossing	6/2/2005	3	dry	
1549	Good Hill Road crossing	6/16/2005	330	wet	
1549	Good Hill Road crossing	7/7/2005	60	wet	
1549	Good Hill Road crossing	7/21/2005	34	wet	
1549	Good Hill Road crossing	5/4/2006	26	dry	**155* (19%)**
1549	Good Hill Road crossing	5/18/2006	108	dry	
1549	Good Hill Road crossing	6/8/2006	220	wet	
1549	Good Hill Road crossing	6/22/2006	44	dry	
1549	Good Hill Road crossing	7/6/2006	**2300* (82%)**	wet	
1549	Good Hill Road crossing	7/20/2006	260	dry	
1549	Good Hill Road crossing	9/7/2006	160	dry	
1549	Good Hill Road crossing	9/21/2006	130	dry	

Single sample *E. coli* data (colonies/100 mL) from Station 1549 on Kettle Creek with annual geometric mean calculated (continued)

Station Name	Station Location	Date	Results	Wet/Dry	Geomean
1549	Good Hill Road crossing	5/10/2007	74	dry	133
1549	Good Hill Road crossing	5/31/2007	26	wet	
1549	Good Hill Road crossing	6/14/2007	126	dry	
1549	Good Hill Road crossing	6/28/2007	164	dry	
1549	Good Hill Road crossing	7/12/2007	156	wet	
1549	Good Hill Road crossing	7/26/2007	136	dry	
1549	Good Hill Road crossing	8/9/2007	540	wet	
1549	Good Hill Road crossing	8/23/2007	220	dry**	
1549	Good Hill Road crossing	5/8/2008	76	dry	97
1549	Good Hill Road crossing	5/22/2008	20	wet	
1549	Good Hill Road crossing	6/12/2008	124	wet	
1549	Good Hill Road crossing	6/26/2008	44	dry	
1549	Good Hill Road crossing	7/10/2008	92	dry	
1549	Good Hill Road crossing	7/31/2008	48	wet	
1549	Good Hill Road crossing	8/14/2008	1580	dry**	
1549	Good Hill Road crossing	9/11/2008	116	dry	
1549	Good Hill Road crossing	9/25/2008	116	dry	

Shaded cells indicate an exceedance of water quality criteria

**** Weather conditions for selected data taken from Hartford because local station had missing data**

***Indicates single sample and geometric mean values used to calculate the percent reduction**

Wet and dry weather *E. coli* (colonies/100 mL) geometric mean values for Station 1549 on Kettle Creek

Station Name	Station Location	Years Sampled	Number of Samples		Geometric Mean		
			Wet	Dry	All	Wet	Dry
1549	Good Hill Road crossing	2005-2008	11	20	88	122	73

Shaded cells indicate an exceedance of water quality criteria

Weather condition determined from rain gauges in Danbury, CT and at Hartford Bradley International Airport

Table 15: Poplar Plain Brook Bacteria Data

Waterbody ID: CT7200-26_01

Characteristics: Freshwater, Class A, Potential Public Drinking Water Supply, Habitat for Fish and other Aquatic Life and Wildlife, Recreation, Navigation, and Industrial and Agricultural Water Supply

Impairment: Recreation (*E. coli bacteria)*

Water Quality Criteria for E. coli:

Geometric Mean: 126 colonies/100 mL

Single Sample: 410 colonies/100 mL

Percent Reduction to meet TMDL:

Geometric Mean: **36%**

Single Sample: **86%**

Data: 2005 - 2008 from Earthplace sampling efforts, 2012 TMDL Cycle

Single sample *E. coli* data (colonies/100 mL) from Station 1551 on Poplar Plain Brook with annual geometric mean calculated

Station Name	Station Location	Date	Results	Wet/Dry	Geomean
1551	Route 33 at Camp M footbridge	5/5/2005	34	dry	70
1551	Route 33 at Camp M footbridge	5/19/2005	35	dry	
1551	Route 33 at Camp M footbridge	6/2/2005	460	dry	
1551	Route 33 at Camp M footbridge	6/16/2005	84	dry	
1551	Route 33 at Camp M footbridge	7/7/2005	32	wet	
1551	Route 33 at Camp M footbridge	7/21/2005	80	dry	
1551	Route 33 at Camp M footbridge	5/4/2006	240	wet**	114
1551	Route 33 at Camp M footbridge	5/18/2006	352	dry**	
1551	Route 33 at Camp M footbridge	6/8/2006	880	wet**	
1551	Route 33 at Camp M footbridge	6/22/2006	252	dry**	
1551	Route 33 at Camp M footbridge	7/6/2006	680	wet**	
1551	Route 33 at Camp M footbridge	7/20/2006	130	dry**	
1551	Route 33 at Camp M footbridge	8/10/2006	36	dry**	
1551	Route 33 at Camp M footbridge	8/24/2006	4	dry**	
1551	Route 33 at Camp M footbridge	9/7/2006	44	dry**	
1551	Route 33 at Camp M footbridge	9/21/2006	36	dry**	

Single sample *E. coli* data (colonies/100 mL) from Station 1551 on Poplar Plain Brook with annual geometric mean calculated (continued)

Station Name	Station Location	Date	Results	Wet/Dry	Geomean
1551	Route 33 at Camp M footbridge	5/10/2007	52	dry**	**197* (36%)**
1551	Route 33 at Camp M footbridge	5/31/2007	140	wet**	
1551	Route 33 at Camp M footbridge	6/14/2007	260	dry	
1551	Route 33 at Camp M footbridge	6/28/2007	196	wet	
1551	Route 33 at Camp M footbridge	7/12/2007	400	wet	
1551	Route 33 at Camp M footbridge	7/26/2007	24	dry	
1551	Route 33 at Camp M footbridge	8/9/2007	**2900* (86%)**	wet	
1551	Route 33 at Camp M footbridge	8/23/2007	104	dry	
1551	Route 33 at Camp M footbridge	9/13/2007	700	dry**	
1551	Route 33 at Camp M footbridge	9/27/2007	116	dry**	
1551	Route 33 at Camp M footbridge	5/8/2008	116	dry**	177
1551	Route 33 at Camp M footbridge	5/22/2008	324	dry**	
1551	Route 33 at Camp M footbridge	6/26/2008	112	dry**	
1551	Route 33 at Camp M footbridge	7/10/2008	160	dry**	
1551	Route 33 at Camp M footbridge	7/31/2008	320	wet**	
1551	Route 33 at Camp M footbridge	8/14/2008	340	dry	
1551	Route 33 at Camp M footbridge	8/28/2008	200	dry	
1551	Route 33 at Camp M footbridge	9/10/2008	110	wet**	
1551	Route 33 at Camp M footbridge	9/25/2008	104	dry**	

Shaded cells indicate an exceedance of water quality criteria

**** Weather conditions for selected data taken from Hartford because local station had missing data**

***Indicates single sample and geometric mean values used to calculate the percent reduction**

Wet and dry weather *E. coli* (colonies/100 mL) geometric mean values for Station 1551 on Poplar Plain Brook

Station Name	Station Location	Years Sampled	Number of Samples		Geometric Mean		
			Wet	Dry	All	Wet	Dry
1551	Route 33 at Camp M footbridge	2005-2008	10	25	137	296	101

Shaded cells indicate an exceedance of water quality criteria

Weather condition determined from rain gauges at Stamford 5 N station in Stamford, CT and at Hartford Bradley International Airport

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